

## PATENT ABSTRACTS OF JAPAN

(11)Publication number : 09-167317  
 (43)Date of publication of application : 24.06.1997

(51)Int.Cl.

G11B 5/39

(21)Application number : 07-325606  
 (22)Date of filing : 14.12.1995

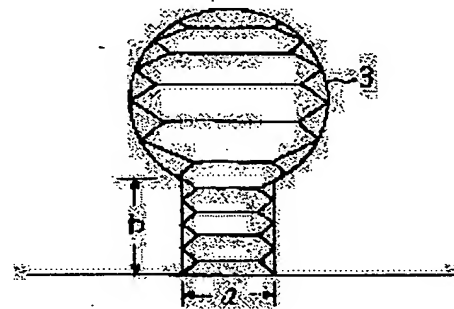
(71)Applicant : FUJITSU LTD  
 (72)Inventor : ODAGIRI MITSURU  
 KOBAYASHI KAZUO

## (54) MAGNETIC HEAD

## (57)Abstract:

**PROBLEM TO BE SOLVED:** To obtain a MR head with little variation in output by providing a magnetoresistive element between 2-layered magnetic shields and making the recess width of the tip part of the magnetic shield smaller than the height of the recess.

**SOLUTION:** Height (b) of a recessed part of a magnetic shield A is made larger than the width (a) of the recessed part. In this way, the stress in the direction of the width at the tip part of the magnetic shield A is relieved, and a tensile stress is added in the direction of the height, and a main magnetic domain and a closure magnetic domain are finely formed in the whole magnetic shield. Such a magnetic domain structure becomes a magnetization process of a rotary magnetization main body, and it can easily return to its original magnetic domain structure when an impressed current is switched off.



## LEGAL STATUS

[Date of request for examination]

[Date of sending the examiner's decision of rejection]

[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]

[Date of final disposal for application]

[Patent number]

[Date of registration]

[Number of appeal against examiner's decision of rejection]

[Date of requesting appeal against examiner's decision of rejection]

[Date of extinction of right]

Copyright (C); 1998,2003 Japan Patent Office

SECRET

SECRET

**THIS PAGE BLANK (USPTO)**

DATA

DATA

DATA

DATA

DATA

DATA

DATA

DATA

DATA

SECRET

\* NOTICES \*

JPO and NCIPi are not responsible for any damages caused by the use of this translation.

- 1.This document has been translated by computer. So the translation may not reflect the original precisely.
- 2.\*\*\* shows the word which can not be translated.
- 3.In the drawings, any words are not translated.

---

CLAIMS

---

[Claim(s)]

[Claim 1] The magnetic head which has the magneto-resistive effect component prepared between two-layer magnetic shielding, and is characterized by the width of face of the recess of this magnetic-shielding point being smaller than the height of this recess.

[Claim 2] The magnetic head which has the magneto-resistive effect component prepared between two-layer magnetic shielding, and is characterized by the width of face of the point of this magnetic shielding being smaller than the height of this magnetic shielding.

[Claim 3] Said magnetic shielding is the magnetic head according to claim 2 characterized by width of face increasing gradually toward the inside [ point ].

---

[Translation done.]

42

[illegible]

1. The first step is to identify the problem or question that needs to be answered. This involves understanding the context and the specific requirements of the task.

100

1. The first of these is the fact that the majority of the population of the United States is of European descent. This is a fact which has been recognized by the government and the people of the United States for many years. It is a fact which has been recognized by the government and the people of the United States for many years. It is a fact which has been recognized by the government and the people of the United States for many years.

**THIS PAGE BLANK (USPTO)**

## \* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## DETAILED DESCRIPTION

## [Detailed Description of the Invention]

[0001]

[Field of the Invention] This invention relates to the magnetoresistive head used for a magnetic disk drive.

[0002]

[Description of the Prior Art] As opposed to a small disk, MR head using the magneto-resistive effect (MR) component prepared between two-layer magnetic shielding as the reproducing head, MR / inductive compound-die magnetic head using the electromagnetic-induction mold magnetic head for which an output does not depend on the peripheral speed of a disk as a recording head (record playback discrete-type magnetic head) It is used abundantly.

[0003] In this compound-die magnetic head, the magnetic flux generated by passing a current in a coil is led to a magnetic core, magnetic flux leaks outside about the gap of a magnetic core, and the recording head is recording the signal on the record medium. Moreover, the magneto-resistive effect component for playback is a head using the phenomenon in which the electric resistance changes with external magnetic fields.

[0004] Next, the structure of the magnetic head of general MR / inductive compound die is shown in drawing 6. Drawing 6 (A) and (B) It is the explanatory view of the conventional example of the magnetic head of MR / inductive compound die.[0005] Drawing 6 (A) Sectional view Drawing 6 (B) It is a top view. drawing — setting — 1 — magnetic-reluctance (MR) component 2 — lower-magnetic shielding 3 — up magnetic shielding (lower magnetic pole) Above figure magnetic pole for writing in 4 5 — a lighting coil, 101, and 102 — terminal of a magneto-resistive effect component (electrode) 501 and 502 It is the terminal of a lighting coil.

[0006]

[Problem(s) to be Solved by the Invention] It is general, An MR head is a record medium. (disk) In order to improve track recording density, magnetic shielding is prepared in the both sides of MR component. In MR / inductive compound-die magnetic head, the so-called yaw angle loss arises according to the range difference of MR component section of the reproducing head, and the gap section of a recording head. For this reason, as shown in the typical sectional view of drawing 2, the head of the structure which served as one side of magnetic shielding and the magnetic pole of a recording head is considered.

[0007] as mentioned above Since an MR head is a head only for playbacks When usually using for a magnetic disk drive, it is necessary to consider as the magnetic head of MR / inductive compound die combining the inductive head for record. Since one inductive head was performing record and playback before adopting an MR head, the difference of a location was not produced with a recording track and a regenerative track. However, MR component section reproduced with the head of a compound die, Range difference will be produced between the record gap sections which record. A location gap arises between the track recorded for this range difference, and the track reproduced, Output fluctuation arises by the loss called a yaw angle loss.

[0008] Usual, Magnetostriction arises in a magnetic material. The positive/negative (magnetostriction constant  $\lambda$ ) of magnetostriction can be controlled to some extent to the generate time of a magnetic film. It sets to drawing 2 and is magnetic-shielding A. It usually goes at a tip from a shielding posterior part, and is tensile stress. ( $\sigma > 0$ ) And it is generated so that it may become negative magnetostriction ( $\lambda < 0$ ). At this time, an easy axis becomes parallel to a slider side (magnetic sensing side), and produces an anisotropy.[0009] because — if the angle which spontaneous magnetization and tension  $\sigma$  make is set to  $\theta$  — the energy  $E$  of an elastic magnetic anisotropy — a degree type — it can express — (\*\*\*\*: "bottom of physics [ of a ferromagnetic ] " p140 reference)  $E = (3/2) \lambda \sigma \cos 2\theta$  — being set to  $E = 0$  which is here and is in the most stable condition —  $\theta = \pi/2$  That is, it is because spontaneous magnetization,  $\sigma$ , and the angle to make become 90 degrees.

[0010] If a shielding point is large, it will be easy to generate stress crosswise (direction parallel to a slider side) here from the size effect. The point with wide width of face stops being able to give an anisotropy in the direction which the force will be distributed and was meant easily compared with the small time of width of face, consequently an anisotropy becomes weak toward a point.

[0011] When an anisotropy is strong, the main magnetic domain occupies a big area and the (magnetic domain of drawing 1 and six long and slender square shapes of 3, 4, and 5) of a closure domain (magnetic domain of three square shapes which are the magnetic domains which flow back magnetic flux so that magnetostatic energy may be kept low within shielding, and magnetic flux may run against a front face and may not make a magnetic pole, and adjoin the periphery of drawing 1 and magnetic shielding of 3, 4, and 5) is small. At this time, the anisotropy has arisen strongly in the longitudinal direction of the main magnetic domain, and the easy shaft of magnetization is in the longitudinal direction of the main magnetic domain.

[0012] If an anisotropy becomes weak, since the difference of an easy shaft and a difficult shaft will be lost, the rate of the area which a closure domain occupies increases. If the area of a closure domain becomes large, it will become the magnetization process of a domain-wall-displacement subject mold, and it will become it is bad and unstable outputting the repeatability of magnetic-domain structure.

[0013] That is, at the configuration of the conventional magnetic shielding, it is drawing 5 (A). Since the width of face of a shielding point is wide, only in a point, the direction of tensile stress tends to become a slider side and parallel, and a magnetic anisotropy becomes weaker toward a point, so that it may be shown.[0014] the rate of the area which the closure domain to the whole surface product of magnetic-shielding A will occupy if the magnetic anisotropy in a point becomes weak — increasing — (B) of drawing 5 Or (C) magnetic-domain structure [ like ] — taking — being easy — drawing 5 (C) \*\*\*\* — the vertical crack magnetic domain wall is produced at right angles to a slider side.

With such magnetic-domain structure, if a current flows to a lighting coil at the time of record, it will become a domain-wall-displacement subject's magnetization process, even if it removes a current, it may not return to the original magnetic-domain structure, and magnetic charge is produced near the slider side, and the sense and magnitude of this magnetic charge differ from each other at every record. Such magnetic charge will change the magnetic-bias (bias field impressed in order to enlarge playback output and to set wave of playback electrical potential difference as the linearity operating point) point of MR component at the time of playback, and will cause big output fluctuation to an MR head.

[0015] The purpose of this invention is to obtain an MR head with little output fluctuation.

[0016]

[Means for Solving the Problem] the magneto-resistive effect component with which solution of the above-mentioned technical problem has the magneto-resistive effect component prepared between 1 two-layer magnetic shielding, and the width of face of the recess of this magnetic-shielding point was prepared between the magnetic head smaller than the height of this recess, and 2 two-layer magnetic shielding — having — the magnetic head with the width of face of the point of this magnetic shielding smaller than the height of this magnetic shielding, or 3 — said magnetic shielding is attained by the magnetic head of said two publications which width of face is increasing gradually toward the inside [ point ].

[0017] As shown in drawing 1, when this invention makes height b of the recess section of magnetic-shielding A larger than the width of face a of the recess section, the stress of the cross direction for the point of magnetic-shielding A is opened wide, and tensile stress is added in the height direction. The beautiful main magnetic domain and a beautiful closure domain are formed with the whole magnetic shielding. Such magnetic-domain structure serves as a magnetization rotation subject's magnetization process, and when force current is removed, it return-comes to be easy of structure in the original magnetic-domain structure.

[0018] That is, it becomes easy to produce stress crosswise [ the ] according to a size effect with wide recess width of face or width of face of a shielding point. Therefore, by making the width of face small, only the tensile stress to the gap direction produced from a presentation acts, in \*\*, foreign land nature becomes good with the whole shielding, and clear main magnetic domain and closure domain can be formed.

[0019] Therefore, it is hard to produce magnetic charge harmful at the time of playback, and output fluctuation of an MR head can be suppressed.

[0020]

[Embodiment of the Invention] To a degree The magnetic head of this invention is explained using a Fig. Drawing 3 (A) and (B) It is the explanatory view of the gestalt 1 of operation.

[0021] Drawing 3 (A) Block diagram of a head Drawing 3 (B) It is the magnetic-domain structure model of magnetic-shielding A. drawing 2 and drawing 3 (A) it sets — 1 — magnetic-reluctance (MR) component 2 — magnetic-shielding B 3 — magnetic-shielding A (a lower magnetic pole is made to serve a double purpose) The up magnetic pole for writing in 4 and 5 are the lighting coils for writing.

[0022] In this example, magnetic-shielding A which consists of NiFe can take the recess structure of illustration, recess height b is larger than the recess width of face a, and it can ease the stress of the recess cross direction, and can ease output fluctuation of an MR head.

[0023] Drawing 3 (B) The magnetic domain of six long and slender square shapes which set and occupy a big area is the main magnetic domain, and the rate of the occupancy area has the small magnetic domain of three square shapes which adjoin the periphery of magnetic shielding at a closure domain. At this time, the anisotropy has arisen strongly in the longitudinal direction of the main magnetic domain, and the easy shaft of magnetization is in the longitudinal direction of the main magnetic domain.

[0024] Drawing 4 (A) and (B) It is the explanatory view of the gestalt 2 of operation. Drawing 4 (A) Block diagram of a head Drawing 4 (B) It is the magnetic-domain structure model of magnetic-shielding A.

[0025] drawing — setting — 1 — magnetic-reluctance (MR) component 2 — magnetic-shielding B 3 — magnetic-shielding A (a lower magnetic pole is made to serve a double purpose) Up magnetic pole for writing in 4 5 is a lighting coil for writing.

[0026] Although magnetic-shielding A has taken the configuration without a recess in this example, height b of magnetic shielding A is larger than this point width of face a. Even if such, the magnetic-domain structure where the area of a closure domain is small to the point of magnetic-shielding A can be taken, and a playback output can be stabilized.

[0027]

[Effect of the Invention] According to this invention An MR head with little output fluctuation at the time of playback is obtained.

[Translation done.]

With such magnetic-domain structure, if a current flows to a lighting coil at the time of record, it will become a domain-wall-displacement subject's magnetization process, even if it removes a current, it may not return to the original magnetic-domain structure, and magnetic charge is produced near the slider side, and the sense and magnitude of this magnetic charge differ from each other at every record. Such magnetic charge will change the magnetic-bias (bias field impressed in order to enlarge playback output and to set wave of playback electrical potential difference as the linearity operating point) point of MR component at the time of playback, and will cause big output fluctuation to an MR head.

The purpose of this invention is to obtain an MR head with little output fluctuation.

[Means for Solving the Problem] the magneto-resistive effect component with which solution of the above-mentioned technical problem has the magneto-resistive effect component prepared between 1 two-layer magnetic shielding, and the width of face of the recess of this magnetic-shielding point was prepared between the magnetic head smaller than the height of this recess, and 2 two-layer magnetic shielding — having — the magnetic head with the width of face of the point of this magnetic shielding smaller than the height of this magnetic shielding, or 3 — said magnetic shielding is attained by the magnetic head of said two publications which width of face is increasing gradually toward the inside [ point ].

As shown in drawing 1, when this invention makes height b of the recess section of magnetic-shielding A larger than the width of face a of the recess section, the stress of the cross direction for the point of magnetic-shielding A is opened wide, and tensile stress is added in the height direction. The beautiful main magnetic domain and a beautiful closure domain are formed with the whole magnetic shielding. Such magnetic-domain structure serves as a magnetization rotation subject's magnetization process, and when force current is removed, it return-comes to be easy of structure in the original magnetic-domain structure.

That is, it becomes easy to produce stress crosswise [ the ] according to a size effect with wide recess width of face or width of face of a shielding point. Therefore, by making the width of face small, only the tensile stress to the gap direction produced from a presentation acts, in \*\*, foreign land nature becomes good with the whole shielding, and clear main magnetic domain and closure domain can be formed.

Therefore, it is hard to produce magnetic charge harmful at the time of playback, and output fluctuation of an MR head can be suppressed.

[Embodiment of the Invention] To a degree The magnetic head of this invention is explained using a Fig. Drawing 3 (A) and (B) It is the explanatory view of the gestalt 1 of operation.

Drawing 3 (A) Block diagram of a head Drawing 3 (B) It is the magnetic-domain structure model of magnetic-shielding A. drawing 2 and drawing 3 (A) it sets — 1 — magnetic-reluctance (MR) component 2 — magnetic-shielding B 3 — magnetic-shielding A (a lower magnetic pole is made to serve a double purpose) The up magnetic pole for writing in 4 and 5 are the lighting coils for writing.

In this example, magnetic-shielding A which consists of NiFe can take the recess structure of illustration, recess height b is larger than the recess width of face a, and it can ease the stress of the recess cross direction, and can ease output fluctuation of an MR head.

Drawing 3 (B) The magnetic domain of six long and slender square shapes which set and occupy a big area is the main magnetic domain, and the rate of the occupancy area has the small magnetic domain of three square shapes which adjoin the periphery of magnetic shielding at a closure domain. At this time, the anisotropy has arisen strongly in the longitudinal direction of the main magnetic domain, and the easy shaft of magnetization is in the longitudinal direction of the main magnetic domain.

Drawing 4 (A) and (B) It is the explanatory view of the gestalt 2 of operation. Drawing 4 (A) Block diagram of a head Drawing 4 (B) It is the magnetic-domain structure model of magnetic-shielding A.

drawing — setting — 1 — magnetic-reluctance (MR) component 2 — magnetic-shielding B 3 — magnetic-shielding A (a lower magnetic pole is made to serve a double purpose) Up magnetic pole for writing in 4 5 is a lighting coil for writing.

Although magnetic-shielding A has taken the configuration without a recess in this example, height b of magnetic shielding A is larger than this point width of face a. Even if such, the magnetic-domain structure where the area of a closure domain is small to the point of magnetic-shielding A can be taken, and a playback output can be stabilized.

According to this invention An MR head with little output fluctuation at the time of playback is obtained.

\* NOTICES \*

JPO and NCIP are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

---

DESCRIPTION OF DRAWINGS

---

[Brief Description of the Drawings]

[Drawing 1] The principle explanatory view of this invention

[Drawing 2] The sectional view of the head of this invention

[Drawing 3] The explanatory view of the gestalt 1 of operation of this invention

[Drawing 4] The explanatory view of the gestalt 2 of operation of this invention

[Drawing 5] The explanatory view of the conventional example

[Drawing 6] The structure explanatory view of the conventional example

[Description of Notations]

1 Magneto-resistive Effect (MR) Component

2 Magnetic-Shielding B

3 Magnetic-Shielding A (Lower Magnetic Pole)

4 Up Magnetic Pole

5 Lighting Coil

---

[Translation done.]

THIS PAGE BLANK (USPTO)



## \* NOTICES \*

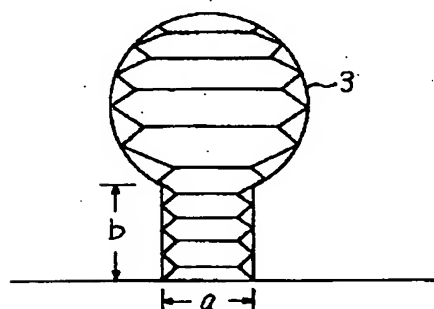
JPO and NCIPJ are not responsible for any damages caused by the use of this translation.

1. This document has been translated by computer. So the translation may not reflect the original precisely.
2. \*\*\* shows the word which can not be translated.
3. In the drawings, any words are not translated.

## DRAWINGS

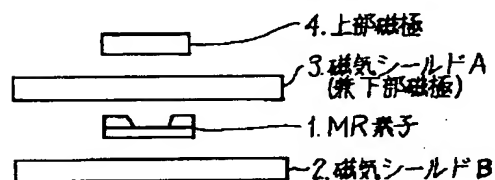
[Drawing 1]

本発明の原理説明図



[Drawing 2]

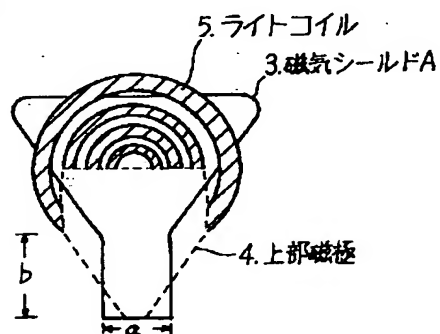
本発明のヘッドの模式断面図



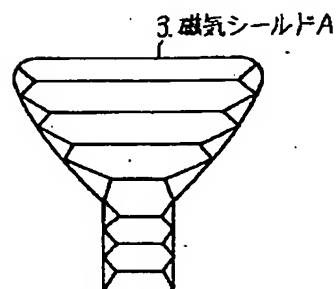
[Drawing 3]

実施の形態1の説明図

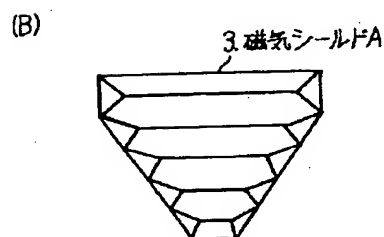
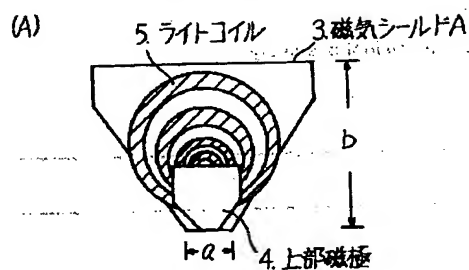
(A)



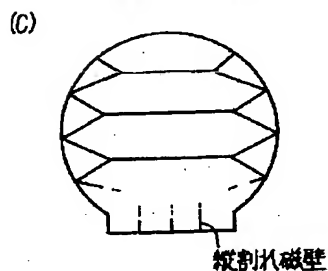
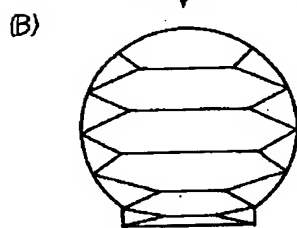
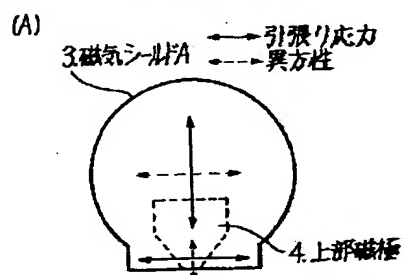
(B)



[Drawing 4]  
実施形態 2 の説明図



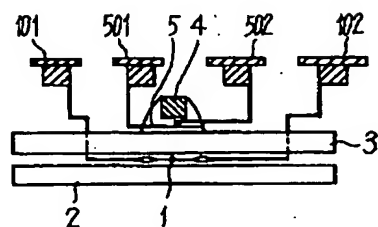
[Drawing 5]  
従来例の説明図



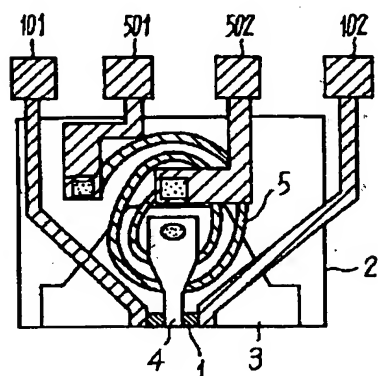
[Drawing 6]

従来例の構造説明図

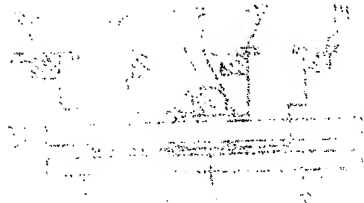
(A)



(B)



[Translation done.]



**THIS PAGE BLANK (USPTO)**

拒絶理由通知書



特許出願の番号 特願2001-036499  
起案日 平成16年10月29日  
特許庁審査官 中村 豊 9186 5D00  
特許出願人代理人 野▲崎▼ 照夫 様  
適用条文 第29条第2項、第29条の2

この出願は、次の理由によって拒絶をすべきものである。これについて意見があれば、この通知書の発送の日から60日以内に意見書を提出して下さい。

理 由

<理由1>

この出願の下記の請求項に係る発明は、その出願前日本国内又は外国において頒布された下記の刊行物に記載された発明又は電気通信回線を通じて公衆に利用可能となった発明に基いて、その出願前にその発明の属する技術の分野における通常の知識を有する者が容易に発明をすることができたものであるから、特許法第29条第2項の規定により特許を受けることができない。

<理由2>

この出願の下記の請求項に係る発明は、その出願の日前の特許（実用新案登録）出願であって、その出願後に出願公告（特許掲載公報の発行又は実用新案掲載公報の発行）又は出願公開がされた下記の特許（実用新案登録）出願の願書に最初に添付された明細書又は図面に記載された発明（考案）と同一であり、しかも、この出願の発明者がその出願前の特許（実用新案登録）出願に係る上記の発明（考案）をした者とは同一ではなく、またこの出願の時において、その出願人が上記特許（実用新案登録）出願の出願人と同一でもないので、特許法第29条の2の規定により、特許を受けることができない。

記 （引用文献等については引用文献等一覧参照）

理由1について

- ・請求項 1-8
- ・引用文献等 1-5

理由2について

- ・請求項 1-8

**THIS PAGE BLANK (USPTO)**

・引用文献等 6

#### 備考

引用例1には、本願と同様の課題が記載されているとともに、記録ヘッドが、外側部分が中央部分よりも後退しているものが記載されている。

また、記録ヘッド部にしても、再生ヘッド部にしても、そのような形状は、引用例2-5にも見られるように一般的なものである。

そして、本願発明について、明細書全体を見ても、磁気素子の中間部分である磁気機能部とその外側部分とは、領域について漠然とそのように呼んでいるだけであり、上記の一般的な形状のものとの違いを見いだすことはできない。

また、先願6にも、特に図3に、本願と同様のものが記載されている。

#### 引用文献等 一 覧

- 1.特開平03-132910号公報
  - 2.特開平04-195801号公報
  - 3.特開2000-123322号公報
  - 4.特開平11-191206号公報
  - 5.特開平09-167317号公報
  - 6.特願2001-109904号(特開2002-222504号)
- 

#### 先行技術文献調査結果の記録

- ・調査した分野 IPC第7版 G11B5/31, 5/39  
DB名
- ・先行技術文献

この先行技術文献調査結果の記録は、拒絶理由を構成するものではない。

**THIS PAGE BLANK (USPTO)**